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Occurrence and distribution of parasites in relation to food components of grey gurnard, *Eutrigla gurnardus* (L.) (Teleostei: Scorpaeniformes), off the Shetland Islands

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Key words: grey gurnard; Shetland Islands; parasite fauna; *Ceratomyxa gurnardi*; *Collarinema eutriglae*; stomach contents; *Trisopterus minutus*; *Euphausia krohnii*

Abstract

The research was conducted on the parasite fauna and food composition of *Eutrigla gurnardus* caught as by-catch in commercial catches of the Atlantic cod *Gadus morhua* near the Shetland Islands. Thirteen species and two genera of pathogens were identified, including six species and one genus recorded for the first time in this host. Copepoda – Euphausiacea dominated in the stomach contents (they are also the intermediate hosts for most of the parasites found), while Gadidae dominated among the fish. A checklist of *E. gurnardus* parasites is included.

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INTRODUCTION

Eutrigla gurnardus has been frequently ranked among the ten demersal dominant species in the North Sea. Since the late 1980s, the grey gurnard has been thought to be responsible for the highest predation mortality among young Atlantic cod *Gadus morhua*, Norway pout *Trisopterus esmarkii* and whiting *Merlangius merlangus* (de Gee & Kikkert 1993). Grey gurnard catch rates in the international bottom trawl surveys have significantly increased in recent years (Floeter et al. 2005), and the species is currently considered a sustainable stock, which permits the future increased use as a food resource (Horst & Levsen 2011).

Although there have been a few studies conducted in the North Atlantic on the parasites of the grey gurnard *E. gurnardus*, basically there are no analyses available on the local grey gurnard parasite fauna. The present study is based on the examination of samples of grey gurnard from the area of the Shetland Islands, which belongs to one of the three sub-populations of grey gurnard inhabiting the North Sea and Skagerrak/Kattegat (one to the northwest of the Dogger Bank, one in the vicinity of the Shetland Islands, and one in the Danish Straits)(Heessen & Daan 1994).

The aim of the present study was to examine the pathogens associated with the grey gurnard in the study area with a focus on their location. The new data on the prevalence of parasite species and their composition are also presented and the most recent checklist of parasites has been added.

MATERIALS AND METHODS

The grey gurnard, *E. gurnardus* (L.), were caught as by-catch (40 specimens) in commercial catches of Atlantic cod *Gadus morhua* L., near the Shetland

Islands (61°10' − 61°30'N and 00°39' − 002°E) at a depth of 125-200 m with a bottom trawl on March 9-11, 2010. The fish were stored frozen. Each specimen was measured (total length TL) to the nearest mm. The body wet weight and liver weight were determined to the nearest 0.1 g.

The age of fish was determined based on the whole sagittal otoliths immersed in the water with reflected light against a dark background under a Nikon SMZ 1000 electronic microscope with a Lucia Measurement System v. 4.6. The ring structures of otoliths were clearly visible, and they were counted from the outer edge of the hyaline zone.

The hepatosomatic index (HSI) as the physiological one to determine whether the diet category affects the fish condition (Lloret et al. 2002), and the feeding index (FI) were calculated:

1. HSI – the ratio between the liver weight and the fish weight was calculated as:

$$HSI = 100 \times \left(\frac{LW}{W}\right)$$

where LW – liver weight (g) and W − fish wet weight (g);

2. FI – the ratio between the number of fish examined with and without the stomach content was calculated as:

$$FI = \left(\frac{NF}{N}\right) \times 100$$

where NF is the number of fish with the stomach content and N is the number of fish examined.

The stomach contents of grey gurnard were analyzed by identifying each prey item to the highest possible taxonomic level. The fish and invertebrate food items were weighed on a scale to the nearest 0.01 g. The food item contribution and the frequency of occurrence in the fish stomachs were established for the whole sample and in two total length classes: 23.1-30.9 cm (class A) and 31.0-42.6 cm (class B) (Table 1). The grey gurnards were categorized as fish, invertebrate, or mixed-diet predators according to the percentage of fish and/or invertebrates in the stomachs of each specimen. Then, the average physiological factors of the three predator groups were compared.

Table 1

Basic data on the grey gurnard (n=40, F=18, M=22, F/M=0.82) in the length classes and in the diet predator groups

Length class (cm)	Body weight (g)	Total length (cm)	Hepatosomatic index (HSI)	Age
	Range and mean ±SD			Range
A length class 23.1-30.9 n=18; F=5, M=13	85.5-233.0 181.57±42.40	23.1-30.9 28.33±2.30	0.97-3.09 1.75±0.70	3-5
B length class: 31.0-42.6 n=22; F=13, M=9	237.3-705.8 360.24±59.02	31.0-42.6 34.18±1.75	1.69-4.23 2.90±1.18	4-8
Diet predator group				
Invertebrate	85.5-468.4 277.58	23.10-37.3 31.58	1.07-4.23 2.15	3-6
Fish	115.9-545.5 293.64	24.8-37.5 31.64	0.97-3.61 1.99	4-7
Mixed diet	159.5-326.0 246.60	26.5-34.0 30.76	1.18-2.88 1.83	3-6
Empty stomach	174.4-705.8 305.23	28.2-42.6 32.26	1.00-3.09 1.95	4-8

Parasite samples

The gills, mouth, and internal organs (esophagus, stomach, intestine, pyloric caeca, liver, heart, spleen, gall-bladder, swim-bladder, and gonads) were examined separately. The muscles were also studied. All parasites were collected and preserved in 70% ethanol. Specimens were prepared for detailed morphological examination and identification in Canada balsam mounts, whereas the remaining specimens were identified in wet mounts. Nematodes and acanthocephalans were examined as wet mounts of saline solution or in temporary mounts of clearing liquids (lactic acid or glycerine).

Parasitological examinations were conducted and the taxonomic consistency of identifications was ensured throughout the study.

The results were analyzed according to the following traits:

1. Quantitative descriptors of parasite populations such as: the percentage of each parasite species in the systematic groups; prevalence (%); infection intensity; abundance (relative density), and dominance (%), which, in addition to permitting the quantification of a parasite as part of the community, allowed their classification into the appropriate class (Czachorowski 2006). Five classes of dominance were distinguish: eudominants (>10%), dominants (5.1% to 10%), subdominants (2.1% to 5%), recedents (1.1% to 2.0%), and subrecedents (<1%).

The index of mean crowding, which quantifies the degree of crowding experienced by an average parasite within a host, was also determined.

The index of discrepancy (Poulin 1993) was applied to detect trends in parasite aggregation patterns. This quantifies the difference between the observed parasite distribution and the hypothetical distribution when all hosts are used equally and all parasites are in subpopulations of equal size within each host. Values of discrepancy are constrained within the limits of 0 to 1, where zero is interpreted as no aggregation and values approaching unity arises when an aggregation is at its theoretical limit and all parasites are found in one host. Descriptive statistics pertaining to parasite infections were calculated separately for each sampling position (Rózsa et al. 2000, Reiczigel 2003).

2. Characteristics of parasite communities (Esch et al. 1988). Parasites in the larval stage and adults whose developmental cycle occurs only in water environments were assigned to autogenic parasite communities. The community of allogenic parasites (in the larval stage) was composed only of parasites, the development cycle of which is partly associated with aquatic environments and partly with terrestrial environments. Considering host specificity, the parasites were classified as generalists or specialists.

RESULTS

The total length of the studied grey gurnard ranged from 23.1 to 42.6 cm, and the weight from 85.5 to 705.9 g. The age ranged from 3 to 8 years. The average length of fish aged 3+ was 24.8 cm, 4+ – 30.8 cm, 5+ – 32.3 cm, 6+ – 35.2 cm. The largest specimen (female) of 42.6 cm was aged 8+.

The HSI index was higher in the length class B − 2.90 ±1.18 (Table 1). With regard to the percentage weight contribution, Invertebrata (crustaceans) dominated (78.4%) in the stomachs of smaller fish (A length class), while fish dominated (60.4%) in the stomachs of larger fish (B length class). Crustaceans occur most frequently in the stomachs of grey gurnard from both length classes. Among crustaceans, the percentage weight contribution of Euphausiacea dominated (99.21-100%) and the dominant species was *Euphausia krohnii*, while Gadidae dominated among fish (74.85-100%) and the dominant species was *Trisopterus minutus*. The size of the smallest specimen of grey gurnard with *T. minutus* in its stomach was 24.8 cm.

Each grey gurnard was categorized as either a fish (22.5% of the whole sample), invertebrate (40%), or mixed diet (20%) predators based on the stomach analysis. The highest value of HSI, which reflects the main reserve of fat stored in the liver (a measure of energy reserves) was noted in the invertebrate predator group (2.15) and was followed by the fish predator group (1.99). The HSI value was slightly lower in grey gurnards with empty stomachs (1.95), and it was the lowest in the mixed diet group (1.83).

General description of the parasite fauna of the grey gurnard

All of the fish examined were infected, and almost all of the pathogens species living in the fish were generalists. The pathogens component communities comprised 1214 individuals of 15 species, of which the pathogen component communities were represented by 1214 specimens of 15 species, including 13 were countable and 2 uncountable species in the spore stage were recorded.

The highest intensity of infection (43 parasite specimens per fish) was noted in the longer fish (B length class), while in smaller fish (A length class) the value of this parameter was 15.2.

There were observed parasites belonging to Myxosporea, Digenea, Cestoda, Nematoda, and Acanthocephala. Spores of the pathogen *Ichthyophonus hoferi* Plehn et Mulsow, 1911 (Mesomycetozoa) – closely related to Metazoa and Fungi (Shalchian-Tabrizi et al. 2008) − were found in the swim bladder, gallbladder, and urinary bladder. The myxosporean *Ceratomyxa gurnardi* Sobecka, Szostakowska, Ziętara et Więcaszek (2013) were observed in the gallbladder. The digeneans *Hemiurus communis* (Odhner, 1905) and *Lecithaster gibbosus* (Rudolphi, 1802) and the nematode *Collarinema eutriglae* Moravec et Sobecka, 2012 were found in stomachs, while larvae of the cestode *Grillotia erinaceus* (van Beneden, 1858) and *Hepatoxylon trichiuri* (Holten, 1802) and the acanthocephalan *Corynosoma strumosum* (Rudolphi, 1802) − on the peritoneum. The nematodes *Anisakis simplex* (Rudolphi, 1809) and *Contracaecum osculatum* (Rudolphi, 1802) were observed in the body cavity and on the internal organs (*A. simplex* was also found in the ventral musculature of one grey gurnard specimen), the nematode *Ascarophis arctica* (Polyanskij, 1952) were found in the stomach and in the intestine lumen, while *Hysterothylacium aduncum* (Rudolphi, 1802) – in the intestine, and *Pseudoterranova decipiens* (Krabbe, 1878) – in the intestine and in the peritoneum, *Capillaria* sp. – in the stomach and in the pyloric caeca and *Ichthyofilaria* sp. – in the stomach and in the intestine lumen.

The only oioxenic parasite found was *Ceratomyxa gurnardi*.

Nematodes were the largest group of parasites (99.43%); the other taxonomic groups were recorded less frequently and represented only by single specimens (Table 2).

The nematode *A. simplex* was the most commonly recorded parasite in grey gurnard (from 1 to 244 specimens per fish). The lowest value of the discrepancy index and the highest abundance, prevalence and crowding were noted for this parasite (Fig. 1). Nematodes *A. simplex*, *Capillaria* sp. and *C. eutriglae* with the highest average intensity of infection were found.

Among the grey gurnard parasites, *A. simplex* was eudominant, *C. eutriglae* was dominant, *Ichthyofilaria* sp., *C. osculatum*, and *H. aduncum* were subdominants, *P. decipiens* was recedent, and six species were subrecedent (*G. erinaceus*, *H. trichiuri*, *H. levinseni*, *L. gibbosus*, *A. arctica*, *Capillaria* sp., *C. strumosum*).

Table 2

Structure of grey gurnard parasitic fauna (countable)

Taxon	Species	L/A	*n*	%[a]	% of tax. group[b]	D
Cestoda	*Grillotia erinaceus* (van Beneden, 1858)	L	1	33.33		0.08
	Hepatoxylon trichiuri (Holten, 1802)	L	2	66.67		0.17
	Total		3		0.25	0.25
Digenea	*Hemiurus communis* (Odhner, 1905)	A	1	50.00		0.08
	Lecithaster gibbosus (Rudolphi, 1802)	A	1	50.00		0.08
	Total		2		0.16	0.16
Nematoda	*Anisakis simplex* (Rudolphi, 1809)	L	976	80.86		80.40
	Ascarophis arctica (Polyanskij, 1952)	A	4	0.33		0.33
	Capillaria sp.	A	5	0.41		0.41
	Contracaecum osculatum (Rudolphi, 1802)	L	37	3.07		3.05
	Hysterothylacium aduncum (Rudolphi, 1802)	L/A	46	3.81		3.78
	Ichthyofilaria sp.	A	55	4.56		4.53
	Pseudoterranova decipiens (Krabbe, 1878)	L	19	1.57		1.57
	Collarinema eutriglae Moravec et Sobecka, 2012	A	65	5.39		5.35
	Total		1207		99.43	99.42
Acanthocephala	*Corynosoma semerme* (Forssell, 1904)	L	2	100.00	0.16	0.17

L/A - L (larva), A (adult); *n* – the number of parasite specimens; [a] – percentage of parasites from particular higher taxa; [b] – percentage of the taxonomic group of parasites in the parasite community; D – the index of dominance of the parasite community components

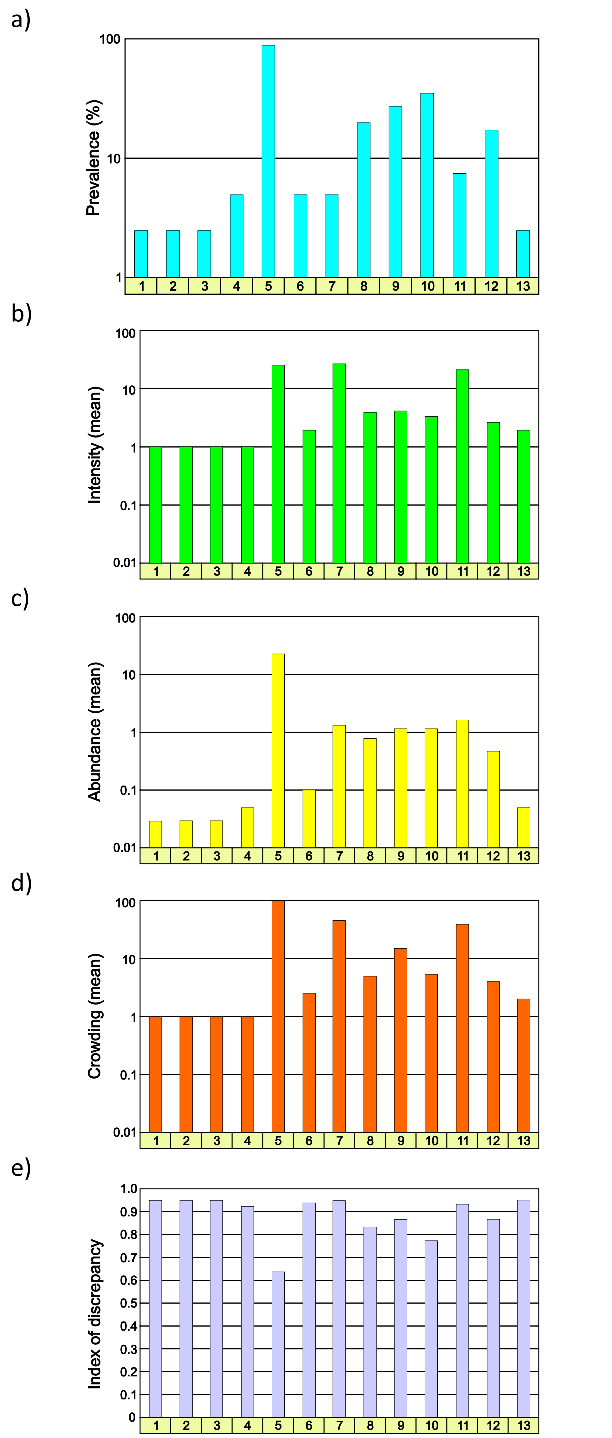

Fig. 1. Prevalence (a), intensity of infection (b), abundance (c), crowding (logarithmic scale) (d) and the index of discrepancy (e) of countable parasites from grey gurnard; 1 – *Lecithaster gibbosus,* 2 – *Hemiurus communis,* 3 – *Grillotia erinaceus,* 4 – *Hepatxylon trichiuri*, 5 – *Anisakis simplex,* 6 – *Ascarophis arctica,* 7 – *Capillaria* sp., 8 – *Contracaecum osculatum,* 9 - *Hysterothylacium aduncum*, 10 – *Ichthyofilaria* sp., 11 – *Collarinema eutriglae*, 12 – *Pseudoterranova decipiens,* 13 – *Corynosoma strumosum*

The parasite community components of the grey gurnard digestive tract was represented by helminths from two higher taxa: Digenea and Nematoda. Nematoda was the richer group according to the species number (eight). Values of the nematode species dominance index were very high (99.42).

The autogenic parasites belonged to Digenea, Cestoda, Nematoda, and Acanthocephala. The parasites were either in the larval or adult stages, except for *H. aduncum*, which occurred in both stages. No allogenic parasites were observed.

Nine parasite species noted in the examined grey gurnards have not been reported previously (Table 3).

Table 3

Check-list of the parasites of *Eutrigla gurnardus* (L.)

Parasite	Location	Geographical distribution	Author
Mesomycetozoa			
Ichthyophonus hoferi (Plehn et Muslov, 1911); cysts	intestine	North Sea near Shetland Islands	Duniec 1980 **present study**
Microspora	muscles of belly lobes	North Sea	Duniec 1980
Myxosporea			
Alataspora lepidum Gaevskaâ et Kovaleva, 1979	gall bladder	Celtic Sea	Gaevskaâ & Kovaleva 1979
Ceratomyxa gurnardi Sobecka, Szostakowska, Ziętara et Więcaszek	gall bladder	near Shetland Islands	Sobecka et al. 2013, **present study**
Monogenea			
Plectanocotyle gurnardi (van Beneden et Hesse, 1863)	gills	Norway, Belgium, British Isles	Hansson 1998
Trochopus pini (van Beneden et Hesse, 1863)	gills	Sea of Marmara	Oguz & Bray 2008
Digenea			
Bucephalopsis gracitescens (Rudolphi, 1819)	stomach	North Sea	Duniec 1980
Derogenes varicus (Müller, 1784)	stomach	North Sea	Duniec 1980
Helicometra gurnardus Thapar et Dayal, 1939 (probable synonym: *H. indica*)	lack of location	aquarium of the Zoological Society's Museum of London	Dawes 1956
Hemiurus communis Odhner, 1905	stomach	English Channel near Shetland Islands	Dawes, 1968, **present study**
Hemiurus levinseni Odhner, 1905	stomach	North Sea	Duniec 1980
Hemiurus luehei Odhner, 1905	intestine, stomach	North Sea	Duniec 1980
Lecithaster gibbosus (Rudolphi, 1802)	stomach	near Shetland Islands	**present study**
Lepidapedon sp.	intestine	North Sea	Duniec 1980
Rhipidocotyle galeata (Rudolphi, 1818)	intestine	North Sea	Dawes 1968, Duniec 1980
Stephanostomum baccatum (Nicoll, 1907) Manter, 1934	intestine	North Sea	Køie 2000
Steringophorus furciger (Olson, 1868)	stomach	North Sea	Duniec 1980
Cestoda			
Grillotia erinaceus (van Beneden, 1858), larvae	stomach	North Sea	Duniec 1980 **present study**
Hepatoxylon trichiuri (Holtem, 1802), larvae	on the peritoneum	near Shetland Islands	**present study**
Scolex pleuronectis Müller, 1788, larvae	intestine	North Sea	Køie, 2000
Tetraphylidean larvae	intestine	Mudanya Cost, the Sea of Marmara	Oguz & Bray, 2008
Nematoda			
Anisakis simplex (Rudolphi, 1809), larvae	stomach, body cavity, liver, and gonads	North Sea, North Atlantic, Faroe Islands, near Shetland Islands	Duniec 1980, Køie, 1993, **present study**
Ascarophis arctica (Polyanskij, 1952):	stomach, intestine lumen	near Shetland Islands	**present study**
Capillaria sp.	intestine	North Sea, near Shetland Islands	Duniec 1980, **present study**
Collarinema eutriglae Moravec et Sobecka, 2012	stomach	near Shetland Islands	Moravec & Sobecka 2012, **present study**
Contracaecum osculatum (Rudolphi, 1802), larvae	body cavity and on/in the internal organs	near Shetland Islands	**present study**
Hysterothylacium aduncum (as *Contracaecum aduncum*) (Rudolphi, 1802), larvae and adult	intestine, stomach; gill cavity	North Sea, North Atlantic, Faroe Islands, near Shetland Islands	Duniec 1980, Køie 1993, **present study**
Hysterothylacium rigidum (Rudolphi, 1809) Deardorff et Overstreet, 1981, larvae	stomach	North Atlantic, Faroe Islands	Køie 1993
Ichthyofilaria sp.	intestine	near Shetland Islands	**present study**
Pseudoterranova decipiens (Krabbe, 1878), larvae	intestine and peritoneum	near Shetland Islands	**present study**
Acanthocephala			
Acanthocephaloides propinquus (Yamaguti, 1935)	intestine	Gemlik Bay, the Sea of Marmara	Gibson et al., 2005
Corynosoma strumosum (Rudolphi, 1802), larvae	on the peritoneum	near Shetland Islands	**present study**
Copepoda			
Brachiella obes (Krøyer, 1837)	gills, oral cavity	North Sea	Duniec 1980
Caligus brevicaudatus Scott, 1901	mouth	Liverpool Bay	Scott 1901
Caligus curtus Müller, 1785	skin	Irish Sea	Kabata 1979
Caligus diaphanous von Northman, 1832	skin	European Atlantic seaboard	Kabata 1979
Caligus elongates von Northman, 1832	skin	European Atlantic seaboard	Kabata 1979
Caligus gurnardi Krøyer, 1863	skin	European Atlantic seaboard	Kabata 1979
Lernentoma asellina (L.)	gill cavity	eastern Atlantic	Kabata 1979
Neobrachiella bispinosa (von Northman, 1832)	gills	North Sea and Atlantic coast of Europe and the western Mediterranean	Kabata 1979
Neobrachiella triglae (Claus, 1860)	gills	North Sea and British waters	Kabata 1979

DISCUSSION

The results of the present study show that crustaceans are the basic food for fish in the smaller length class, while the importance of fish (expressed as the percentage weight contribution) significantly increases in the larger length class. In the case of frequency, however, the crustaceans were reported most frequently in both length classes (50% and 63.60%, compared to 33.3% and 50% of fish, respectively). Moreno-Amich (1994) reported that crustaceans are the basic food with regard to both frequency and contribution, while teleosts are quite important in the diet of adult grey gurnard inhabiting the Catalan coast. The ratio of fish to invertebrates in gurnard stomachs can largely vary from year to year, and Kotterba (2008) reported that the average contribution of fish to the diet in the 25-30 cm length class was 72.8% and 20.2% in 1991 and 2007, respectively. Studies conducted by Weinert et al. (2010) in the vicinity of the Dogger Bank in the central North Sea revealed that the amphipod *Hyperia alba* was the most abundant species found in gurnard stomachs, followed by *Crangon allmani,* and that the dominant vertebrates included the sandeel family (Ammodytidae) together with the species *Ammodytes marinus*. In the present study, the euphausiid *Euphausia krohnii* was the most abundant species, while poor cod *Trisopterus minutus* (Gadidae) dominated the vertebrates.

It appears from the main results of analyses conducted by de Gee & Kikkert (1993) that grey gurnards feed mainly on juvenile fish, a high proportion of which are commercially used gadoids, and that the ontogenetic shift from the invertebrate-dominated to fish-dominated diet occurs at a rather small size of approximately 20 cm (in the present study – 24.8 cm).

In the present study, specimens preying on invertebrates exhibited higher HSI values than those with a fish or mixed diet. In the work by Weinert et al. (2010), the highest HSI values were recorded for specimens with a mixed diet.

All parasites of grey gurnard from the area of the Shetland Islands have complex life cycles and are passed passively through the food chain into the fish, which are the intermediate (paratenic) or definitive hosts.

Nematodes were the largest group of parasites accompanied by few parasites from the other taxonomic groups. Planktonic crustaceans are the first intermediate hosts in the life span of nematodes, who also represent 78.4% of the weight contribution in the length class A and 39.6% in the class B of the sample studied, respectively. Among them, the species from the order Euphausiacea dominated; they are also the most common intermediate host of the nematode *Anisakis simplex* (Nagasawa 1990). The dominance of the generalist Arctic-Boreal nematodes represented a characteristic feature of the regional fauna. *Anisakis simplex*, *C. osculatum* and *H. aduncum* are able to use fish host species that are available in a given water body (Perdiguero-Alonso et al. 2008). Thus it seems that the juvenile grey gurnards have become infected with nematodes. Additionally, juveniles of *Trisopterus minutus* (Gadidae) were found in the stomachs of the fish studied, especially from the B length class, which feed on planktonic crustaceans (mostly Euphausiacea) (Cohen et al. 1990). Therefore, juveniles of *T. minutus* may constitute a supplementary reservoir of nematode larvae.

In the parasite community components of the grey gurnard, the dominant species was the nematode *A. simplex*, which represented over 80% of the parasitic Metazoa observed. *Anisakis simplex* was also the species found most frequently over a period of 30 years in grey gurnard occurring in the vicinity of the Shetland Islands (Duniec 1980).

While *A. simplex* was the most abundant and crowded (Fig. 1), the value of the discrepancy index was the lowest, which indicates that aggregation decreases as the prevalence of infection and the mean number of parasites per host increases. Since an increase in the prevalence means that parasites exploit a greater proportion of available hosts, they are thus not concentrating in only a few of them (Poulin 1993). Experimental studies have shown that the extent of spatial aggregation in the infective stage distribution is reflected in the level of parasite aggregation across hosts. But the absence of any heterogeneity in exposure and even small differences in susceptibility among hosts can rapidly produce non-random, aggregated distributions of parasites (Anderson & May 1978, Keymer & Anderson 1979). Comparative studies of aggregation suggest that the infection process and the habitat of the host may make significant contributions to the pattern of aggregation among species.

Metazoa infect fish examined as early as in the juvenile stage, and parasite accumulation surpasses the mortality over time. The relationship between the fish length and the number of *A. simplex* larvae (7.6 larvae per one infected fish in the A length class and

41 larvae in the B class) indicates the importance of feeding intensity for the accumulation of these nematodes in the host.

Apart from higher values of infection intensity, the grey gurnard from the vicinity of the Shetland Islands were in good condition (Table 1). Most of the parasites found were nematode larvae (*A. simplex, C. osculatum, P. decipiens*) in the third stadium, the location of which was the body cavity and/or the outer side of the internal organs (encysted). Since they do not feed in this stage, they do not affect the host condition. The parasite community components in the grey gurnard digestive tracts were poor so they also do not affect the fish condition.

Only one species of the grey gurnard parasites was likely oioxenic, or specific to a single host; four fish were a microhabitat for myxosporean *Ceratomyxa gurnardi* spores, which has been found for the first time in this host species. To date, *Alataspora lepidum* Gaevskaâ & Kovaleva (1979) has been described as a celozoic myxosporidian in the gallbladder of grey gurnard from the Celtic Sea, but the shape and dimensions of the spores found in these studies are definitely different.

To date, no other hosts of the nematode *Collarinema eutriglae* have yet been discovered, and nothing is known about its life cycle. Nematodes usually have more than one definitive host, so probably *E. gurnardi* is not the only host species. The highest number of nematodes (49 specimens) was found in the alimentary tract of a fish, whose stomach also contained Euphausiacea (A length class). It is possible that crustaceans from this order are the intermediate host of *C. eutriglae*.

The larvae or plerocerci of the trypanorhynch cestodes *Hepatoxylon trichiuri* and *Grillotia erinaceus* have been found in many fish species that are paratenic or intermediate hosts, and a few larval cestodes have been reported encysted in the elasmobranch tissue suggesting that they can also serve as the intermediate host (Palm 2004). While *H. trichiuri* was not observed in the study by Duniec (1980), one specimen of *G. erinaceus* was noted, similarly to the present study. However, in the description of the life cycle of this species, Ruszkowski (1934) reported that the second intermediate host is a fish species of *Eutrigla*. On the other hand, this parasite species was observed in large quantities in haddock, *Melanogrammus aeglefinus* (L.) (Lubieniecki 1976) in the study area.

Only two species of digeneans – *Lecithaster gibbosus* and *Hemiurus communis* – were found in the stomachs of two examined fish. The first parasite has never been observed in grey gurnard, while the second was reported by Duniec (1980) as *Hemiurus luchei*, and also in the earlier studies of Nicoll (1909, 1914). The metacercariae of this species have been recorded on several occasions in the northeast Atlantic on copepods, chaetognaths, and ctenophores. The larger fish become infected while feeding on small plankton feeders, especially gadoids (Gibson & Bray 1986), which are often observed in the diet of grey gurnard, including the present study. Meskal (1967) suggests that old specimens of *H. communis* die from early fall to February. The life span of this digenean in the cod appears to be about eight months. This may be the reason why there were so few digeneans in the grey gurnards examined, which were caught in March.

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